by three wires from a rigid tower, has done good work in the writer's observatory, but such an instrument has obvious drawbacks. Fig. 4 shows an arrangement, also used by the writer, and called a "duplex pendulum." A common pendulum with a ring bob, B_1, is connected to an inverted pendulum, B_2, by a ball-and-tube joint, which compels the bobs to move horizontally together. The combination can be made as nearly astatic as may be desired by proportioning the masses of the bobs to the lengths of the suspension-rods. The inverted pendulum stands on a joint which gives two freedoms to rotate but prevents twisting about a vertical axis; an extension of its rod upwards forms the multiplying arm, and carries a tracing pointer.

Another plan is shown in Fig. 5, which may be described as a duplex pendulum with a single bob, whose weight is borne partly by a socket below and partly by a spring from a support above. Any one of these instruments affords a single steady-point with respect to all motions in azimuth. Their principal use is to give "static" records of the horizontal motion, that is, records traced on *fixed* plates, which show at a glance the changes in direction of displacement during the occurrence of an earthquake.

In attempting to register the vertical component of earthquake motions, we meet with the difficulty that the weight of the mass whose inertia is to furnish a steady-point acts in the direction in which freedom of motion is to be retained. A weight hung by a spiral spring from a support above it is too stable to act as a seismometer, unless the spring be impracticably long. A horizontal bar fixed to a wall by a flexible joint and loaded at its end—an old device used by the British Association Committee at Comrie in 1842—is open to the same objection. If the loaded bar is rigid, but pivoted about a fixed horizontal axis, and held up by a spiral spring near the axis of support, we obtain a much slower period of free oscillation than if the spring were directly loaded with a weight which would stretch it to the same extent. Mr. Gray has rendered this device as nearly astatic as may be desired by adding a small tube containing mercury, whose effect is to increase the load when the bar goes down and to decrease it when the bar goes up. Another and simpler way of attaining the same result is shown in Fig. 6, which represents the vertical seismograph used in Japan by the present writer. There *a* is a horizontal bar pivoted about a horizontal axis on two points at *c*, with a heavy bob, *b*, whose weight is borne by a pair of springs, *d*. But the upward pull of the springs, instead of being applied to the bar in the line joining the axis *c* with the centre of gravity, is applied *below* that line by means of the stirrup *e*. Consequently, if the bar goes down, the pull of the springs, although increased above its normal value, is applied nearer to the axis, and (by properly adjusting the depth of *e* below the bar) the moment of the pull of the springs may thus be kept as nearly equal to the moment of the weight as may be desired—a condition which of course secures astaticism. The centre of percussion of the loaded bar is the steady-point, with respect to which the vertical motions of the ground are recorded by the multiplying lever *l* on the rim of a revolving glass plate, *o*, which may be the same plate as that which receives the record of the two horizontal components.

The instruments which have been briefly described succeed in registering very completely all the movements of the ground at an observing station during the occurrence of an ordinary earthquake, and some of them could be adapted with little difficulty to the registration of violent convulsions. It would be outside the scope of this paper to deal with the appliances by which Rossi and others have investigated those minute and almost incessant tremors of the soil whose very existence no observations less fine and careful would serve to detect.

J. A. EWING

NOTES

THE meeting for organisation of the American Association for the Advancement of Science will be held on Thursday morning, September 4; and on Friday evening, September 5, after the address of the retiring President (Prof. Charles A. Young, of the College of New Jersey), a general reception will be tendered by the citizens and ladies of Philadelphia to the members of the British and American Associations, and the ladies accompanying them. The British Association has been cordially invited, both by the American Association, to take part in their proceedings, and by the Local Committee representing citizens of Philadelphia, to accept the warm welcome which will be tendered them during the joint session. The Local Committee for the Philadelphia meeting is divided into a number of sub-committees, which have been specially created to render the stay of their visitors agreeable. It is earnestly requested that every one who intends to participate in this meeting will send his name, together with the number of ladies and gentlemen in his party, at as early a date as possible, to Dr. Persifor Frazer, Secretary of the Committee on Invitations and Receptions, 201, South Fifth Street, Philadelphia. During the week occupied by the session a number of receptions, entertainments, and excursions will be given, and a day will be set apart for the examination of the International Electrical Exhibition, to be held at Philadelphia, under the auspices of the Franklin Institute, and commencing September 2. By an arrangement between the Canadian and United States trunk lines, the members of the British Association will be furnished with first-class passage from Montreal to Philadelphia and return for 15 dollars (3*l.* 1*s.* 8*d.*), or for the single trip from Montreal to Philadelphia for 9 dollars (1*l.* 17*s.*). It is to be hoped that these rates will be further reduced before the members of the British Association will be ready to take advantage of them.

THE Executive Council of the International Health Exhibition have determined to hold an International Conference on Education in connection with the Education Division of the Exhibition: they have appointed a Committee of Management, who have drawn up a programme. For convenience of discussion all papers to be read will be printed beforehand, and they will subsequently be published by the Executive Council. Persons desirous of attending the Conference are invited to send in their names to Mr. R. Cowper, Secretary to the Committee of Management, International Health Exhibition, South Kensington, to whom any inquiries can be addressed. The following are the subjects for discussion:—1. Conditions of Healthy Education. 2. Infant Training and Teaching: (*a*) Kindergarten; (*b*) Instruction generally. 3. Technical Teaching: (*a*) Science; (*b*) Art; (*c*) Handicrafts; (*d*) Agriculture; (*e*) Domestic Economy. 4. Teaching of Music in Schools. 5. Museums, Libraries, and other Subsidiary Aids to Instruction in Connection with Schools. 6. Training of Teachers. Under this head will be considered the right professional preparation for teachers in (*a*) elementary, (*b*) intermediate and higher, (*c*) special and technical schools. 7. Inspection and Examination of Schools: (*a*) by the State; (*b*) by the Universities; (*c*) by other public bodies. 8. Organisation of Elementary Education. 9. Organisation of Intermediate and Higher Education. 10. Organisation of University Education. 11. Systems of Public Instruction in various Countries.

THE Albert Medal of the Society of Arts has been awarded by the Council of the Society, with the approval of the Prince of Wales (the President), to Capt. James Buchanan Eads, "the American engineer, whose works have been of great service in improving the water communications of North America, and have thereby rendered valuable aid to the commerce of the world."

THE death is announced of the celebrated Danish entomologist, Prof. J. C. Schiödte, at the age of sixty-nine.

THE St. Petersburg Academy of Sciences intends to publish the valuable documents which came into its possession from the great expeditions of the last century, of Krasheninnikoff, Müller, Pallas, and Messerschmidt; they are still unknown, as also the correspondence of the great explorers of Russia and Siberia.

A NEW scheme of a Polar expedition has been recently submitted by several officers of the Russian Navy to the Minister, Admiral Shestakoff. Starting from the idea that it is impossible to reach the North Pole by sea on account of the archipelagos that cover the circumpolar region, the Russian officers propose to start an expedition on sledges from the New Siberia Islands, which are 900 nautical miles distant from the Pole. This space is to be covered by sledge parties, who would make depots of provisions on the newly-discovered islands, and thus slowly but surely advance towards the north, securing at the same time the return journey of the expedition. When elaborated, the scheme will be submitted to the learned Societies, and the necessary money raised by subscriptions.

WE understand that the Commissioners under the new Universities (Scotland) Bill, if passed as it stands at present, will have power to establish, if they find it expedient, a Science Faculty in the Universities or in some of them, and to make provision for a curriculum or course of study in such Faculty which shall be coordinate with the curriculum or course of study in the Faculty of Arts. The Bill has the approval of the Senatus Academicus University of Edinburgh.

MR. JAMES JACKSON, the librarian of the Paris Geographical Society, has drawn up a useful table showing the extent to which the metrical system is used. In the following countries the system is legally obligatory:—

	Population		Population
Argentine Republic	2,830,000	Italy	28,459,451
Austria-Hungary	37,786,346	Mexico	10,046,872
Belgium	5,520,009	Netherlands	4,172,971
Bolivia	1,957,352	Norway	1,806,900
Brazil	9,883,622	Paraguay	346,048
Chili	2,199,180	Peru	2,699,945
Colombia	4,000,000	Portugal	4,160,315
Denmark	1,969,039	Roumania	5,073,000
Equador	946,033	Spain	16,634,345
France & Colonies	46,843,000	Sweden	4,579,115
Germany	45,234,061	Switzerland	2,846,102
Greece	1,979,305		
			241,973,011

In the following countries the metrical system is optional:—Canada, 4,324,810; United States, 50,419,933; Great Britain and Ireland, 35,241,482; Persia, 7,653,600; total, 97,639,825. In the following countries the system is often used without its having legal value:—

	Population		Population
Egypt	6,820,000	Uruguay	438,245
India	198,755,993	Venezuela	2,075,245
Russia	100,372,553		
Turkey	24,804,350		333,266,386

THE Duke of Norfolk has indicated his intention of contributing 3000*l*. towards the technical department of the Firth College, Sheffield.

THE East of Scotland Naturalists' Union held a very successful meeting in Dundee on Friday and Saturday last. Dr. Buchanan White gave an instructive and interesting address; various reports were given in, papers read, and a largely-attended *conversazione* held in the evening. On the Saturday a dredging excursion was made to the Bell Rock.

THE Manchester Field Naturalists have been spending the Whitsuntide holiday in Sherwood Forest. On the way to Mansfield, which was chosen as the head-quarters of the party, a short stay was made in the mountain limestone region of Derbyshire, to examine the geology of Brick Cliff. An interesting feature of the programme was the visit made to the Creswell Caves (in a pretty ravine of the magnesian limestone) under the guidance of the Rev. J. Magens Mello, one of the principal explorers of the caves, from which, it will be remembered, important remains of the post-Pleiocene Mammalia and Neolithic instruments have been obtained. The weather was very propitious, and the visit very enjoyable.

THE seventh annual meeting and *conversazione* of the Midland Union of Natural History Societies will be held at Peterborough on Wednesday, June 25. Excursions will be made to Stibbington Hall, Bedford Purlieus, and the Decoy in Borough Fen and Croyland on Thursday, June 26. The annual meeting will be held in the Fitzwilliam Hall, Peterborough, on Wednesday, June 25, at three o'clock, the President of the Union (the Very Rev. the Dean of Peterborough) in the chair. The business of the meeting will be to receive the Report of the Council and the Treasurer's accounts; to fix the place of the next annual meeting in 1885; to award the Darwin Medal for the year 1884; to consider any suggestions that members may offer; to discuss the work of the Union during the coming year; and to transact all necessary business. The President will open the meeting with an address.

MR. F. W. EASTLAKE of Tokio informs us that the well-known Devonian Brachiopod, *Spirifer disjunctus*, in common with several other Devonian genera such as *Rhynconella*, *Cornulites*, *Spirorbis*, and the like, is called by the Chinese *shi-yên* or "Stone Swallow," and that the powdered shell is largely sold by the native druggists as a specific in urinary and renal disorders. He has obtained a specimen of the shell from South Formosa, which he regards as indicating a prolongation of that Devonian formation which, commencing with Hainan and Southern China, is traceable throughout the Loochoos and the southern provinces of Japan. *Spirifer disjunctus* is not uncommon in the Mikado's Empire, but as it is highly prized on account of its supposititious medicinal virtues, it is possible, if not probable, that the fine specimens obtained from the Japanese were originally brought from China. The very fact that *Spirifer disjunctus* is one of the ornaments of the Eastern Asiatic pharmacopœia renders it unusually difficult to trace the locality whence the Brachiopod may have been brought.

THE new Scandinavian mathematical journal, *Acta Mathematica*, has already gained such a reputation that the French Government has decided to subscribe for fifteen copies for the Facultés des Sciences. In his note to the Swedish Ambassador in Paris on this subject M. Jules Ferry points out that it is the first time his Government has supported a foreign publication, which he trusts will be an acknowledgment of the high international position the *Acta Mathematica* has gained and of the value it has become to French science. This journal is also supported by the three Scandinavian Governments.

WITH the brig *Lucinde*, which has just left Copenhagen, Lieut. Jensen of the Danish Navy, Dr. Lorentzen, and the painter Ris-Carstensen, left for Greenland for the purpose of measuring, and exploring geologically and geographically, the country between Holstensborg and Sukkertoppen, the shore of which is very broad—it is estimated about sixty miles. As this part of Greenland has never been visited by Europeans, our knowledge of its natural condition is limited. The natives state that there are deep fjords here, and great high plateaux partly covered with glaciers.

ON May 14, at 12.30 a.m., a remarkable phenomenon was observed at Nyköping in Sweden. The weather was dull and rainy, when suddenly streamers of light were seen in the northern sky running from west to east. They were seen twice, the first time lasting about a minute, but the second very short. The light was so intense that the streets became quite light.

THE Museum of the Kendal Literary and Scientific Institution possesses a valuable series of Carboniferous fossils. Most of the zoological groups are well represented, especially in relation to Brachiopoda and Gasteropoda, the former containing large examples of *Productus giganteus*, Martin, and the latter important specimens of *Euomphalus crotolostomus*, M'Coy, and *Phanerotinus cristatus*, Sowerby. The fossils are chiefly local, many of them having been collected by the once well-known geologist of Kendal, John Ruthven, who prepared the geological map for Miss Martineau's "English Lakes." This collection has recently been named, classified, and catalogued by Mr. R. Bullen Newton, F.G.S.

IN the letter by M. Antoine d'Abbadie in NATURE for May 29 (p. 101), the passage, "it was then 24m. 8s. past midnight," should be omitted.

THE additions to the Zoological Society's Gardens during the past week include two Squirrel Monkeys (*Chrysothrix sciurea* ♂ ♀) from Brazil, presented by Mr. Robert Thom; two Black-eared Marmosets (*Hapale penicillata* ♂ ♂) from South-East Brazil, presented by Mr. C. D. Middleton; a Common Squirrel (*Sciurus vulgaris*), British, presented by Mrs. Grover; a Marsh Ichneumon (*Herpestes galera*), a Dusky Ichneumon (*Herpestes pulverulentus*) from South Africa, presented by Dr. Holub, C.M.Z.S.; two Sociable Vultures (*Vultur auricularis*) from Africa, an Angolan Vulture (*Gypohierax angolensis*) from West Africa, presented by Sir Donald Currie; a Gray Amphisbæna (*Blanus cinereus*) from Spain, presented by Mr. W. C. Tait, C.M.Z.S.; a Burchell's Zebra (*Equus burchellii* ♀) from South Africa, two Common Camels (*Camelus dromedarius*) from Egypt, five Horned Lizards (*Phrynosoma cornutum*) from North America, deposited; five Goldeneyes (*Clangula glaucion*), five Common Snakes (*Tropidonotus natrix*), twenty-four Green Lizards (*Lacerta viridis*), European, purchased; a Japanese Deer (*Cervus sika* ♀), a Mexican Deer (*Cervus mexicanus* ♀), a Long-fronted Gerbille (*Gerbillus longifrons*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

THE OBSERVATORY OF PARIS.—Admiral Mouchez's report on the state of this establishment and the work accomplished therein during the past year commences with some details of his scheme for erecting a succursal observatory at a distance from Paris, where the disadvantages of location in the midst of a great city would be avoided. His proposal was to dispose of a part of the actual grounds of the Observatory, a step which would be likely to realise a sum adequate to the erection of the new building, at the same time retaining the present one to form the head-quarters of the Bureau des Calculs, the Archives, and the Museum, the two establishments to remain under the same direction and to constitute together the Observatory of Paris. This scheme, it is known, has not met with general acceptance at the hands of the scientific authorities.

M. Lœwy, in charge of the Meridian Service, has been occupied with the reobservation of stars in the Catalogue of Lalande, while a large number of observations of the sun, moon, and planets has also been made, eighteen observers taking part in this work in the course of the year. The equatorials of 12 and 14 inches aperture and the equatorial *coudé* were employed on observations of comets and small planets. The Ecliptical Charts Nos. 12, 19, 48, and 67 have progressed, and attention has been paid to double-star measures. M. Mouchez reports that the construction and installation of the great telescope (0·74 m.) has been retarded by the difficulty of establishing it in the grounds of the Observatory at Paris. In the Department of Astronomical Physics MM. Thollon and Trépied had been occupied for six weeks on the Pic du Midi, where, with M. Naussinat, in present charge of the Observatory, they studied the advantages of the station, more especially for solar observations, concluding that great scientific interest would attach to work that might be accomplished during the four or five weeks of the fine season in a small observatory at that point. Funds for the purpose are not yet available.

M. Mouchez further reports upon the distribution of time in Paris, the additions to the Museum during the year, which consist of instruments of the last century found in the Observatory of Toulouse, a portrait of Copernicus, &c.; the work of the Bureau des Calculs, which remains in charge of M. Gaillot; the publications of the Observatory during the year, including vol. xvii. of the *Annales*, in which are some important memoirs theoretical and practical; and the personal work of the staff.

A plan of the grounds of the Institution is appended, on which are distinguished those portions which M. Mouchez had proposed to alienate with the view to providing means for the erection of an observatory at a distance from Paris.

THE GREAT COMET OF 1882.—In an appendix to the Washington Observations, 1880, is an account prepared by Mr. W. C. Winlock, at the desire of the Superintendent of the Naval Observatory, Admiral Shufeldt, on the great comet of 1882 as observed at Washington, first with the 9·6 inch and subsequently with the 26-inch refractor. The latest date on which the comet's position was determined is April 4, 1883. Micrometrical measures of the nucleus were made on a number of evenings, and from a plate showing its aspect and formation between February 1 and March 3 the difficulty of deciding upon the proper point for observations of position, owing to the existence of several almost equally luminous condensations in the head of the comet, is very apparent. For a similar reason, in another plate the points observed with the transit-circle from September 19 to March 3 are shown. There has rarely, if ever, existed a greater need for precautions of this nature, to assist in the combination of the places obtained at various observatories, for the accurate determination of the orbit. The comet was first seen at Washington shortly after noon on September 19, and was visible for several hours to the naked eye about twenty-eight minutes preceding the sun and 1°·2 further south. In the 9·6-inch equatorial "it presented the appearance of a bird with wings extended," a description that applies to other comets that have been seen in daylight or in a very strongly illuminated sky, as for instance the first comet of 1847, figured in Johnston's "Atlas of Astronomy."

GEOLOGICAL NOTES

CANADIAN COALS AND LIGNITES.—Dr. G. M. Dawson collects and publishes, chiefly from the Reports of the Geological Survey of Canada, some useful Notes on the Coals and Lignites of the Canadian North-West. These mineral fuels are all of Cretaceous and Tertiary age. They are extensively developed near the Bow and Belly Rivers and their tributaries, extending eastward from the base of the mountains to about the 111th meridian; but as this is the only region yet examined in detail by the Survey, there may yet prove to be other districts of equal value. Where the Cretaceous rocks have been much disturbed and folded, the coal passes into the condition of anthracite, of which a seam occurs on the Cascade River near its confluence with the Bow River and close to the line of the Canadian Pacific Railway. Out on the plains, however, the strata are nearly flat, and as they recede from the mountains the coals show a larger percentage of water, and assume more or less completely the character of lignites.

BELGIAN ERRATICS.—To the already cited examples of fragments of Scandinavian rocks in the post-Tertiary deposits of Belgium Mr. E. van den Broeck has recently added the discovery of a piece of granite (measuring 0·8 × 0·5 × 0·6 metre) in the most northern part of the kingdom, embedded in the fine Campinian sands of Wortel—apparently the first Belgian example of any fragment large enough to claim perhaps the name of an erratic block (*Ann. Soc. Géol. du Nord.* xi. p. 2).

POSITION OF THE CALLOVIAN ROCKS.—M. Paul Choffat protests against the inclusion of the Callovian among the Upper Jurassic formations, as was decided at the last Conference of the International Commission on Geological Nomenclature. This decision, based on the palæontological affinity of the Callovian and Oxfordian stages he believes to be theoretically false and to be practically impossible of application in any general map of the whole of Europe. He gives a *résumé* of obser-